

We Claim:

1 1. A method for controlling a gap in an electrically conducting solid
2 state structure, comprising the steps of:

3 providing an electrically conducting solid state structure including a
4 gap in the structure;

5 exposing the structure to a fabrication process environment conditions
6 of which are selected to alter an extent of the gap in the structure;

7 applying a voltage bias across the gap in the structure during process
8 environment exposure of the structure;

9 measuring electron tunneling current across the gap during process
10 environment exposure of the structure; and

11 controlling the process environment during process environment
12 exposure of the structure based on tunneling current measurement.

1 2. The method of claim 1 wherein controlling the process
2 environment comprises halting process environment exposure of the
3 structure based on tunneling current measurement.

1 3. The method of claim 1 wherein controlling the process
2 environment comprises comparing tunneling current measurement with a
3 threshold tunneling current corresponding to a prespecified gap extent and
4 controlling the process environment based on the comparison.

1 4. The method of claim 1 wherein the conditions of the fabrication
2 process environment are selected to increase an extent of the gap in the
3 structure.

1 5. The method of claim 1 wherein the conditions of the fabrication
2 process environment are selected to decrease an extent of the gap in the
3 structure.

1 6. The method of claim 1 wherein the fabrication process
2 environment comprises ion beam exposure of the structure.

1 7. The method of claim 6 wherein the ion beam exposure comprises
2 blanket ion beam exposure of the structure.

1 8. The method of claim 6 wherein the ion beam exposure comprises
2 rastering of the structure by a focused ion beam.

1 9. The method of claim 1 wherein the structure comprises two
2 electrically conducting electrodes having a gap between the electrodes.

1 10. The method of claim 9 wherein the electrically conducting
2 electrodes are disposed on an electrically insulating membrane including an
3 aperture aligned with the gap between the electrodes.

1 11. The method of claim 9 wherein the electrically conducting
2 electrodes are disposed on an electrically insulating surface of a substrate.

1 12. A method for controlling a gap between electrically conducting
2 electrodes, comprising the steps of:
3 providing at least two electrodes on a support structure, each electrode
4 having an electrode tip that is separated from other electrode tips by a gap;
5 and

6 exposing the electrodes to a flux of ions causing transport of material of
7 the electrodes to corresponding electrode tips, locally adding material of the
8 electrodes to electrode tips in the gap.

1 13. The method of claim 12 wherein the support structure comprises
2 a substrate

1 14. The method of claim 13 wherein the substrate comprises an
2 electrically insulating surface on which the electrodes are disposed.

1 15. The method of claim 12 wherein the support structure comprises
2 a membrane including an aperture aligned with the electrode gap.

1 16. The method of claim 12 wherein the support structure comprises
2 a substrate including a trench aligned with the electrode gap.

1 17. The method of claim 12 wherein the electrodes comprise metal
2 electrodes.

1 18. The method of claim 12 wherein the ion flux exposure of the
2 electrodes comprises blanket ion beam exposure of the electrodes.

1 19. The method of claim 12 wherein the ion beam exposure of the
2 electrodes comprises rastering of the electrodes by a focused ion beam.

1 20. The method of claim 12 further comprising:
2 applying a voltage bias across the gap between electrodes during ion
3 flux exposure of the electrodes;

4 measuring an electron tunneling current across the gap, between
5 electrodes, during ion flux exposure of the electrodes; and
6 controlling the ion flux exposure of the electrodes during ion flux
7 exposure of the electrodes based on tunneling current measurement.

1 21. The method of claim 20 wherein control of the ion flux exposure
2 of the electrodes comprises halting of the ion flux exposure.